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HEADLINE: Crash dummies take rollercoaster ride

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BODY:

CRASH-TEST dummies are to be used by government investigators on rollercoasters and other "white-knuckle" rides amid growing fears about their potential dangers.

Funfair visitors are regularly subjected to forces of more than 4G, which rival those experienced by Nasa astronauts on takeoff. Customers have complained of bleeding eyes, while one researcher has warned the rides could cause brain damage.

Scientists at a Health and Safety Executive (HSE) research centre in Sheffield have devised a crash-test dummy with sensors to measure the effect of G-forces. "Early rollercoasters basically just went up and down, but modern rides will put you through corkscrews, banked curves and loop-the-loops," said Alan Jackson, a scientist at the laboratory. The forces are now much more complex and force-related injuries have happened on rides, he added.

The crash-test dummies, which will be used for spot checks on amusement parks and accident investigations, are equipped with three sensors, or accelerometers, which are smaller than a sugar cube and can measure pressure on different parts of the body.

In 1997-98, more than 300 people were injured in fairgrounds and amusement parks in incidents reported to the HSE. Last year people riding a gyroscope machine in Barnsley complained of bleeding eyes after the ride. "I was going so fast that the G-force hurt my eyes and I couldn't breathe," said Nicola Sobelewski, 18. "It was like being spun in a washing machine."

The machine - a circular steel cage that spins a single passenger round and round - has been investigated by the HSE. Using dummies, it discovered the ride could subject the body to an acceleration of 4G, forcing blood into the head and bursting tiny blood vessels in the eyes.

Investigators have also examined a ride in Northern Ireland - a swing which travels through 360 degrees - after a passenger fell to his death. Passengers are kept in their seats by a lap bar, but the man who died got under the bar and stood up.

The HSE's equipment showed that when the ride reached the top he would have

been subjected to a force of 3G. To prevent himself being flung out he would have had to resist a force three times his own body weight.

An inquiry into a log flume ride on which a passenger suffered a fracture of the spine revealed that the boat in which the woman's back was damaged experienced forces that peaked at 9G. On the investigators' advice, engineers made the log's fall less steep and adjusted the water level to prevent the boat stopping so suddenly.

Researchers are worried that the users of some rides might suffer hidden effects. Valerie Biousse, a Paris-based neurology specialist, has treated patients who complained of headaches after high-speed rides. She said subsequent examinations revealed ailments ranging from minor internal bleeding to small strokes.

Britain has no regulations governing fairground rides, but health and safety law requires that they are inspected regularly by qualified engineers.

One of the country's newest rides is the Oblivion rollercoaster at Alton Towers, which has a vertical drop of 160ft into a tunnel. When the ride levels out, passengers experience 4.5G, which means they are four-and-a-half times heavier than normal.

"When we talk about pulling more than 4G, it is only for a very short time," said Liz Greenwood, a press officer at Alton Towers. "If you were a fighter pilot you would experience greater forces for a much greater period of time. Nobody who has used the ride has complained of any problems."

Dr John Roberts, a director at the engineering consultancy Allott and Lomax, an accred ited inspector of rides, said there were no statutory fixed limits for G-forces on rides, but it was widely accepted that they should not exceed 5G. "Using crash dummies means you can accurately assess what the force is going to be," he said.

Once the data are collated, the statistics on the G-force will be superimposed on a video of the ride which will enable the investigators to assess exactly how the passengers are reacting to the acceleration and the likelihood of injuries.

G-forces are measured in relation to gravity. In normal conditions, gravity pulls the human body to the earth with a force of 1G. When the G-force increases, so does body weight.

Astronauts on takeoff experience 3 or 4G, which makes it harder to breathe and forces the blood to the legs, which is why they are strapped down with their legs pointing upwards. Fighter pilots are subjected to greater forces because of the sharp turns in combat. On rollercoasters the forces pushing passengers into their seats are limited to about 4G while the lateral forces are about 1G. The high G-forces are only momentarily experienced to ensure there are no dangerous side effects.

"Fighter pilots are trained for 'grey-outs' and loss of consciousness," said Jackson. "In general, the forces that a person will experience on a fairground ride are transient. We want to establish a database so we can tell exactly what the G-force limits should be."

The research has already improved the design of restraints after investigators discovered that small people often cannot reach footrests and can be twisted under lap bars.